Climate change project with
GLOBE-program 2006

The GAME SIDE of GLOBE

Yaounde

November 2006

PREFACE

Welcome to using our booklet! The booklet is an outcome of GLEN/ASA/GLOBE 2006 project. It is to be used by all teachers and students worldwide interested in studies about environment and climate change. The idea of making this booklet arose about half into our exchange project. We realized the need for a documented form of our work, and not just a report to be submitted to the sponsors of the project. The context and content of this booklet therefore evolved alongside the idea of the booklet itself. Climate scientists, science educationists and pedagogists have done a lot in terms of the type of material that can be found in this document, but the result of this project in Estonia, Germany and Cameroon is the original pre-occupation leading to this publication. The readers should therefore not hesitate to contribute their ideas to the authors in any of the three countries. Help us learn so as to help you and others to learn.

DEDICATION

This project report is dedicated to the students of Kivilinna Grammar, Suure-Jaani Grammar and Kääpa Primary School in Estonia; Max-Planck and Fridjof-Nansen Schools in Kiel in Germany; GSS Buea Rural, SAKER Baptist College Limbe, GTTC Buea, Lycee Bilingue de Kribi, GHS Tatum, CBC Bali, GBHS Ndop and GBHS Bamendankwe in Cameroon, for their interest in nature protection.

ACKNOWLEDGEMENT

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We are also indebted to the authorities of the Tartu Botanic Garden, Estonia; Living Earth Cameroon Foundation, Yaounde, Limbe Botanic Garden, Limbe and Teachers Resource Center in Bamenda, Cameroon.

To all who have supported this project morally, materially or otherwise, to Gosia Matysek for proof reading, we say:

Täname, Dankeschön, Thank you, Merci!

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TABLE OF CONTENT

1. THE GLOBE-PROGRAM AND CLIMATE CHANGE PROJECT IN 2006

1.1. The GLOBE Program

Global Learning and Observation to Benefit the Environment, the acronym for GLOBE, is hands on environmental science and education program involving more than 110 countries of the world. GLOBE links primary and school students, teachers and the scientific research community in an effort to learn more about our environment through student data collection and observation.

The goals of GLOBE are:

- To enhance the environmental awareness of individuals throughout the world.
- To contribute to scientific understanding of the earth.
- To help all students to reach higher levels of achievement in science and mathematics.

Becoming a GLOBE Program Partner

Countries or agencies become GLOBE Partners through a protocol of agreement. GLOBE is managed in each country or agency by the Coordinator. In the case of the Country, the Country Coordinator selects the schools to participate in the program. To date, the GLOBE Program has involved tens of thousands of schools and teachers and over 1 million students around the world in GLOBE workshops and educational activities.

Next Generation GLOBE

The next step in the evolution of the GLOBE Program is described as “Next Generation GLOBE (NGG)”. The vision of the NGG is a Program working in close partnership with the National Aeronautic and Space Administration (NASA) and the National Science Foundation (NSF), Integrated Earth Systems Science Program to give the worldwide GLOBE Community access to top scientists, and expose them to programs that are on cutting edge of Earth Systems research. To achieve this vision, GLOBE will promote and support students, teachers and scientists associated with NSF and NASA – funded Integrated Earth System.

As part of the NGG, GLOBE will implement and assess three new approaches to program implementation: Regional consortia, project – based Management and the development of GLOBE School Networks (GSNs) and GLOBE Alumni.

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1.2. Why I like the GLOBE-program

Ten years with GLOBE

Estonia joined to the GLOBE program in 1996. It was a period of rapid changes in our country after becoming independent in 1991. Development of the new content in environmental education, and providing schools with the internet connection were actual at that time. Many teachers and school principals recognized GLOBE as an excellent opportunity for an educational innovation in our country. Students in about 5% of all schools started to implement GLOBE protocols and sending data to the international student data base. Today, there are 40 GLOBE schools and about 1,000 students yearly engaged in the program (which is not a small number for a country with only 1,4 million inhabitants). During 10 years the Estonian students have sent over 420,000 measurement data to the GLOBE data base. Participation in the world-wide network was (and is) highly appreciated by students, as well as teachers and school principals. The world was opened for us: many schools have developed partnerships with GLOBE schools in other countries. We have opened for the world: good work within GLOBE enabled even the smallest country-side schools to be visible in the wide world.

GLOBE-games and students' conferences

However, the global issues alone were not enough for maintaining the students' and teachers' enthusiasm for a long-term participation in the program. An important task was building the GLOBE community within the country. It was achieved by bringing together teachers, students and scientists in face to face meetings. We have been organising the annual GLOBE Games since 1998. Those summer camps are the best places for students to get to know eachother, learn about nature and have fun together. The GLOBE schools from neighboring countries (Latvia, Norway, Finland, Russia) are also invited. The nature exploration in GLOBE Games is commonly guided by scientists, students themselves also organize the social activities on environmental issues. The funny part in GLOBE Games 2006 has been a role game „GLOBE program in cinema", where teams created and presented „movies" in different genres, like science fiction, thriller, melodrama, etc.

We have put a lot of emphasis on creative use of the student environmental data. We have organized yearly competitions of student research projects, and national students'

conferences since 2000. During these events all participants have an opportunity to introduce their research in a 5-minutes PowerPoint presentation. Therefore GLOBE students are chanced to give their first scientific presentations being only 11-12 years old.

Benefits for science education in my country

The GLOBE program has brought to our schools free educational materials (which were translated into Estonian), new technologies (GPS, satellite images), new instruments (chemical sets, GPS receivers, radiation thermometers), new methodologies (scientific method, treating earth as a complex system, modeling), new scientific concepts (remote sensing, GIS, data bases). This is a lot for a small country where the in-country capacities for educational innovation are limited.

Moreover, a new understanding of global and local environmental issues was introduced to teachers and students. Through acting in GLOBE we got to know people from the whole world, who share our concerns about the better environment and education. The personal contacts with the outstanding scientists from our country, as well as from NOAA and NASA have been encouraging for many students to choose their future studies in the field of science.

Teachers acting in the GLOBE program use the scientific method, hands-on activities and nature exploration in their work. The GLOBE community is trying to share the gained experience with other schools and teachers: we have published adapted measurement protocols, lesson plans and environmental games, organized teachers' training workshops in the counties. Indeed, the GLOBE is only a small part of the national educational system, and it is difficult to fit it as a whole in the regular curriculum. However, numerous teachers already use the learning activities derived from the GLOBE program in their open-air lessons and schools' science days.

What GLOBE means for me

As a person, I have got a feeling of being a world citizen. The environmental problems and political events in any part of the world influence me, since those could affect some of my friends, members of the GLOBE family. Meeting uncountable amount of open-minded persons and bright-thinking school kids in my country give me hope for the better future and possibilities for sustainable development. I have received a lot of energy from the GLOBE community in Estonia, coming from enthusiastic, positive, and thoughtful people.

As a scientist, I have got a wider view on the Earth science, compared to my collequaes who act only as physicists or chemists.

I am happy that GLOBE has offered a chance for children for nature exploration, without doubt it has transformed them persons that cave about the environment, and helped them to choose their future professions.

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1.3. The GLEN/ASA/GLOBE 2006 project

GLOBE Program aims at bringing the world closer together, and give a hands-on approach to science education as well as intercultural exchange, global learning and education networking.

The GLEN network connects development education and aid organizations such as ASA and AKÜ to work together in the framework of project. Therefore students from European nations, and those from South America, Africa and South Asia have the opportunity to study on various topics in groups, in their partner-countries abroad, as well as at home.

The GLEN/ASA/GLOBE 2006 Project is the first within GLOBE, which provided means where its alumnus from different countries worked and studied together. Mari Nuga from Estonia, Simone Lepper from Germany, Christine Leonie and Leslie Njume from Cameroon have brought together to fulfill one shared aim that is to deepen studies on environmental education and make it practical; to contribute to the understanding of global climate change, especially from the perspective of Estonia, Germany, and Cameroon, as well as sharing the spirit that a joint universal effort is needed in those topics to make our world a better place.

The project in its six-month duration was executed in the Republic of Estonia (coordinated by Martin Pentson, chairman of the Estonian GLOBE Alumni - Gloobus, and Prof. Ülle Kikas, researcher at the Institute of Environmental Physics, University of Tartu, who doubles as the country GLOBE coordinator for Estonia); the Federal Republic of Germany (coordinated by Birgit Rademacher in the Leibniz Institute of Science Education, University of Kiel, as the GLOBE Germany coordinator, closely assisted in the project by Mark Müller), and in the Republic of Cameroon (coordinated by Mrs. Margaret Besong, national pedagogic inspector and country coordinator for GLOBE Cameroon).

Understanding the environment, climate and the global climate change is not restricted to any particular person or group of persons. The more aware people are of it, the better the results of such a global endeavor. The development of teaching material was indeed a tough aim of the project and will enable students, teachers and facilitators to make the topic more interesting and understandable.

This booklet thus should make such material available to as many users as possible, with contributions such as contents from expert climatologists and scientists around the world, teachers, facilitators and the project participants.

The booklet is therefore for all who share the spirit of global climate change being one of the world's most dreaded environmental hazards and so should be treated as such.

This project lasted only for half a year, but the idea lives in this booklet, whose desire is to be used, shared, and developed.

So the producers call on all users to become active and share their spirit of global education and climate change as the most global topics in environmental studies, and therefore play an active role in the organization of international conferences and co-operations such as this project.

2. KNOWLEDGE ABOUT CLIMATE

2.1. Climate and global climate change

Global climate change is real. The surface temperature of the earth increased during the last hundred years by about 0.8°C. The larger fraction of this warming, about 0.6°C, is due to man's activities. We produce energy basically by burning fossil fuels (oil, coal, natural gas). This is associated with the emission of vast amounts of carbon dioxide (CO_2) into the atmosphere. Carbon dioxide is a so-called green house gas. It interacts with the earth's radiation balance and leads, together with other trace gases such as methane (CH_4), to global warming. Global warming has led to melting mountain glaciers world wide (a retreat of the Arctic sea ice cover by about 20% since the 1970s, an increase of global sea level by about 20 cm during the last century) and more frequent extreme weather events. Climate models predict an additional warming until 2100 in the range of 1.4-5.8°C. This large range is mostly due to uncertainties in the future emissions of green house gasses into the atmosphere. If we act and significantly cut green house gas emissions, we may expect a warming up to 2°C. If, however, emissions continue to grow, the temperature change will be of the order of several degrees. Such a warming will be unprecedented in the history of mankind both in terms of the absolute level and the rate of change. For instance, a global warming of more than 3°C until 2100 will lead to the complete melting of the Greenland ice sheet, which corresponds to a global sea level rise of about 6 m. It is unclear, however, how long it will take to melt the ice sheet completely. Estimates range from a few hundred to a thousand years.

Global warming will lead to changes in the hydrological cycle. Many regions would suffer from severe droughts. Others will get excessive rainfall. For example, southern Europe may become a desert. Coastal regions will be endangered by the sea level rise, and the Polar Regions in the Northern Hemisphere will experience the strongest warming, with changes of up to 10°C until 2100. The emission of carbon dioxide into the atmosphere does not only lead to global climate change, but also to an acidification of the oceans. The oceans take about 30% of the carbon dioxide emitted by us. This has led to an acidification of the seawater that we can already measure. The acidification is in the long term a major threat to marine life. If the CO_2 emissions continue to grow globally, we may face a pH-value in 2100 that did not prevail during any time in the last 20 million years. Detailed information on global change can be obtained from the reports of the Intergovernmental Panel on Climate Change (IPCC), which can be downloaded at www.ipcc.ch.

In order to prevent these serious changes, we have to cut globally the emission of greenhouse gases into the atmosphere by about 90% until 2100. In order to achieve this goal, efforts must be made to save energy on the one hand and to make more use of renewable energy on the other hand. In particular, better techniques to make use of the solar energy should be developed. Since the climate is a slowly responding system, the transition of a carbon-based to a carbon-free economy can be realized within the next hundred years.

In this context, the GLOBE project is an important component to save our environment. Young people worldwide will be educated to protect the environment by involving them in an earth monitoring system. Since we are dealing with a global problem, the global nature of this programme is appropriate. The understanding of the earth system helps to increase public awareness and to avoid activities that are harmful to the environment. As such, GLOBAL is a milestone, which will help to protect our planet.

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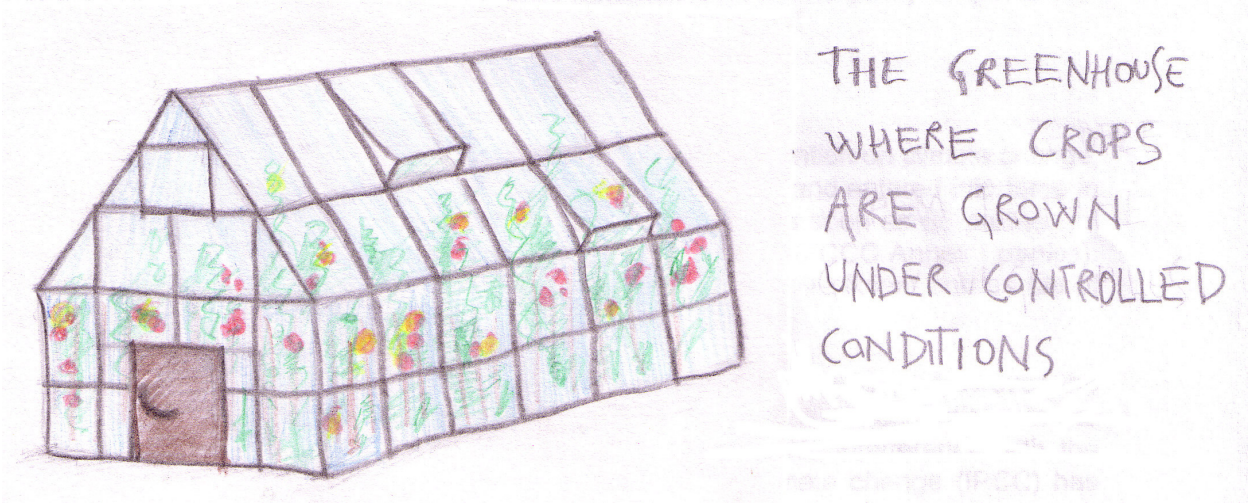
2.2. CO_2-emission

Many activities demand energy: cooking, transport, laundry, washing, cooling, heating… The supply of this energy produces CO_2 and other eventually harmful gases (CFCs, greenhouse gases). Therefore everyone pollutes the atmosphere and causes global climate change. The energy demand of the world is increasing as a sign of development. While satisfying our energy demands, we should consider how environmentally friendly the sources and use of energy are. As we can not stop our energy demand it is wiser to use cleaner energy sources. There are several sources of energy and it is important to know the advantages and disadvantages of each source not only in the context of CO_2-emission. Although the role play focuses on CO_2-emission as one controllable cause of global warming, it is necessary to make the pupils understand that “environmentally friendly” is a term that has many dimensions. Global challenges need also local solutions.



Common energy sources for making electricity in Cameroon are hydropower and natural oil. In Estonia mainly oil shale is used. Germany uses mainly coal, mineral oil and nuclear power, but renewable energy sources such as wind, sun and waste energy are growing quickly. The German government promotes strongly the use of renewable energies.

In Cameroon there is no need for heating houses because of the warm climate, but wood and natural gas are used for cooking. But the demand for cooling devices is growing. In Estonia the heating is used 2/3 of the year. Natural oil, gas, wood, coal, beat and electricity is mainly used for heating. In Germany houses are heated during winter times mainly with oil, gas and electricity.

Generally energy demand in heavily industrialized countries is bigger than in less industrialized ones. But often developing countries pollute the most as their energy demand is growing very quickly but their efforts and means to use less polluting technologies remains poor.

In general energy sources include coal, oil shale, gas, mineral oil, nuclear power, wind, solar, hydropower, biofuel, recyclables and waste energy. CO_2-emission varies greatly from country to country depending on how the exhausts are treated. Producing solar energy would be the cleanest technology but at the moment there exist no clean technology to produce solar panels. Therefore those panels do not pay back the CO_2-emission. Still in some parts of the world it is the best solution to supply “clean” energy.

When it comes to transport the best solution for reducing CO_2-emission is without doubt a effective public transport system.

However, CO_2-emission and atmospheric pollution does not only influence the ones who emit. Greenhouse gases do not know boundaries that is why a global effort is needed for coping with climate change

2.3. International climate change agreements

This project has a special focus on global climate change education and it is therefore our wish to share with the readers the aspects of international collaboration. During the lesson the pupils often discovered that an individual can do much more than they expected, on the other hand they saw that climate change is a real global problem – not bound to any borders and need therefore international agreements. In this article, we talk about three major world treaties relating to climate change studies.

The Vienna convention

The Vienna convention for the protection of the ozone layer (1985) which outlines states responsibilities for protecting human health and the environment against the adverse effects of ozone depletion established the framework under which the Montreal Protocol was negotiated.

The Montreal protocol

The Montreal protocol on substances that deplete the Ozone layer is a landmark international agreement designed to protect the stratospheric ozone layer. It was originally signed in 1987, amended in 1990 and 1992. It was designed such that the stratospheric CFCs, halons, carbontetrachlorides and methyl chloroforms were to be phased out by 2000 (2005 for methyl chloroform). Scientific theory and evidence suggest that, once emitted to the atmosphere, these substances deplete the stratospheric ozone layer that shield the planet from damaging U.V radiations UNEP prepared Montreal protocol handbook that provides additional details and explanations of the provisions.

Ciesin's thematic guide on Ozone Depletion and Global Environmental Change presents an in-depth look at causes, human and environmental effects and policy responses to stratospheric ozone depletion.

The Kyoto protocol

The Kyoto protocol is an amendment to the UN framework convention on climate change, UNFCCC open for signature in December 1997 in Kyoto, Japan and entered into force in February 2005.The treaty was conditioned to enter into force as soon as 55 parties got involved and least 55% CO_2 reduction at 1990 emissions (by UNFCCC Annex I parties). The parties to this agreement involve 166 countries and other government entities (as of October 2006).

The Kyoto protocol is intended to cut global emissions of greenhouse gases. However, the most outstanding fact is that the stabilization of greenhouse gas concentrations in the

atmosphere at a level that will prevent dangerous anthropogenic interference with the climate system UNFCCC. The intergovernmental panel for climate change (IPCC) has predicted an average global rise in temperature of 1.4°C to 5.8°C between 1990 and 2100. Current estimates indicate that even if successfully and completely implemented, the Kyoto protocol will reduce that increase by about 0.02°C to 0.28°C by the year 2050. The U.S.A and Australia have signed but currently refused to ratify it. Nevertheless the agreement came into force in February 2005, following ratification by Russia. In October 2006, a total of 166 countries and other government entities have ratified the agreement. Countries like India and China which have ratified the protocol are not required to reduce CO_2 emissions under the present agreement despite their large populations.

As article 25 of the protocol says it enters into force on the ninetieth day after the date on which not less than 55 parties to the convention have deposited their instruments of ratification, acceptance, approval or accession which was reached in May 2002, after Iceland had ratified (55 parties clause it). The 55% clause brought the treaty into force effectively in February 2005 after Russia in November 2004 ratified.

We acknowledge greatly sources of this information and also recommend the following for you detail search:

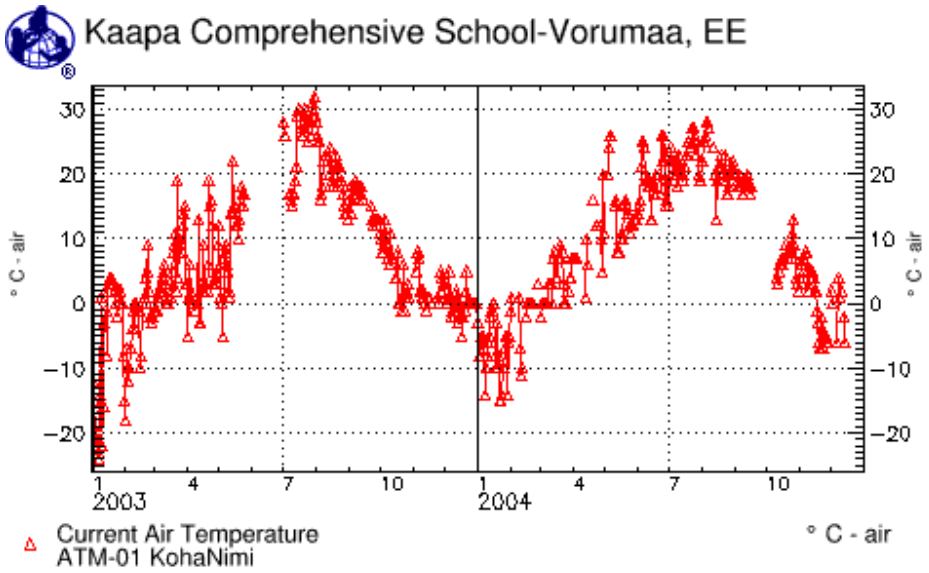
- The evolution of policy responses to stratospheric ozone depletion, Haas (1991)
- CIESIN thematic guides http://www.ciesin.org/TG/PI/POLICY/montpro.html.
- The fourth meeting of the parties to the Montreal protocol, Rowlands (1993)

2.4. The climate of Estonia

Estonia lies in the **temperate zone**. It is situated in the transition region **between the marine and the continental climate**. The climate of Estonia, like of the whole Europe, is influenced by the Atlantic Ocean. The impact of the North-Atlantic stream makes the climate here a little warmer than at the same latitudes in other countries. The weather is quite changeable and we often have strong winds.

There are **four seasons** in Estonia: spring (March, April, May), summer (June, July, August), autumn (September, October, November) and winter (December, January, February). The summer weather can be warm and sunny or cool and rainy. The winter weather can be cold and sunny or warmer and cloudy. Continental air masses are more frequent in the second half of winter, in spring, and in the first half of summer. From time to time in winter and in spring cold arctic air masses bring dry cold weather. The western winds bring along humid maritime air. The yearly duration of sunshine is 1600-1900 hours.

The **annual average temperature** in Estonia is between 4.3ºC and 6.5ºC. The coldest month is February and the warmest is July (average temperature between 16.0ºC and 17.4ºC. The highest air temperature (35.6ºC) was measured on 11 August 1992 in Võru, the lowest (–43.5ºC) on 17 January 1940 in Jõgeva. The frost-free period lasts for 110–190 days.



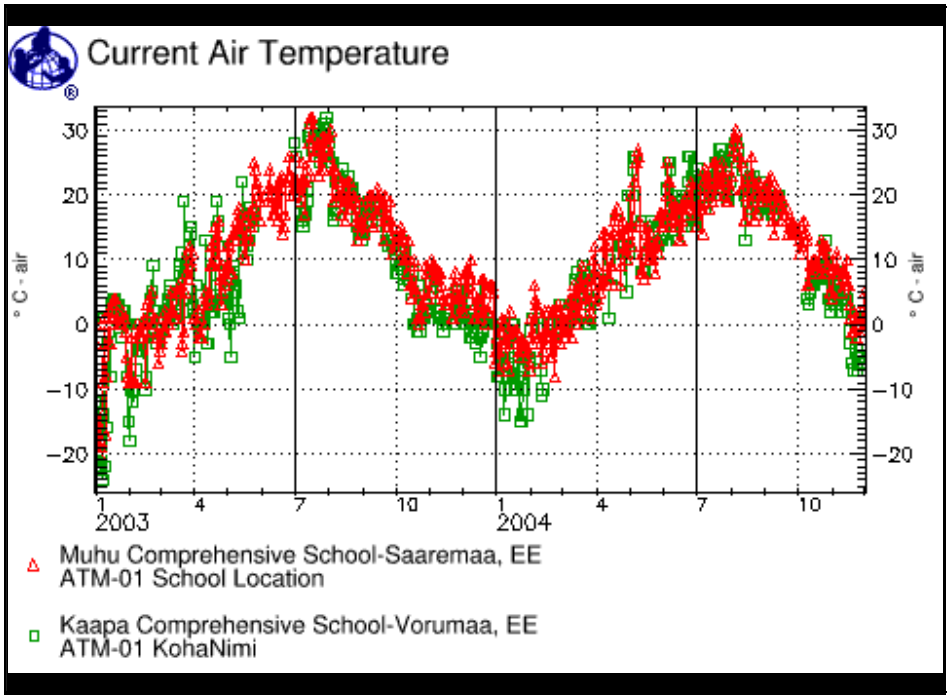
Estonian **climate is humid** - the amount of precipitation exceeds the total evaporation. The annual average of the relative air humidity is 80–83%. It is higher in winter and at its lowest in May. The annual average **precipitation** varies between 550 and 800 mm.

The **snow** covers our land for about 75–135 days. Snow cover remains for the shortest time on the small islands near the western coast and for the longest time on the Haanja and Pandivere Uplands.

Although Estonia is a small country there are **regional differences** in climate caused by the Baltic Sea and the varying relief. In winter the sea keeps the **coastal areas** much warmer than the **inland**. There are smaller fluctuations in the yearly temperatures in the coastal areas because the sea warms up and cools down more slowly than the inland areas. The coolest areas are located on the uplands, the warmest on the coasts. Towards the winter the contrasts in air temperatures become distinct, in summer these territorial differences begin to disappear.

Many people in Estonia think that our climate is interesting; we can see the changes of the nature during the four seasons. The worst time is November, when the nights are very long and we don't have snow yet. People feel depressed and wait for the spring but the long days in June make us forget about the cold and dark winter. We are happy that we do not have hurricanes, earthquakes or volcanoes.

Numerical data from www.estonica.org



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2.5. The climate of Germany

The climate of Germany is transitional between a maritime climate in the northwest and a continental climate in the east. The climate in the northwest is influenced to some extent by the Gulf Stream. Air masses from the Atlantic Ocean and the North Sea bring moderate temperatures in winter and cool temperatures in summer to the most parts of western and north-western Germany. These marine air masses also bring plentiful moisture.

In the northwest and in the north the climate is oceanic and rain falls all year round. Winters there are relatively mild and summers tend to be comparatively cool. In the north the average temperatures for example in Hamburg are between 0.3 °C in January and 17.1 °C in July. In the northwest for example in Essen the average temperatures are 1.5 °C (35 °F) in January and 17.5 °C in July.

In the central part and in the south the climate varies from moderately oceanic to continental. The more south a location is the more continental gets the climate. Hot summers with temperatures about 30 degrees Celsius are possible. Winters can be cold and with frequent snowfalls. The average temperatures in Munich are –2.2 °C in January and 17.6 °C in July.

In the east the climate shows clear continental features. The temperatures in January are generally below freezing and winters can be very cold for long periods. Summers are warm and pleasant. Rain falls transitional but do not last too long. They can become very warm and long dry periods are often recorded. The average temperatures in Berlin are between 0.9 °C in January and 18.6 °C in July.

Winter temperatures vary from west to east, with around freezing temperatures in the west and well below freezing in the east of Germany. Summer temperatures are typically between 20 °C and 30 °C, with more rainfall during the summer months, that guarantees a green and fertile landscape. Annual mean precipitation varies according to region. It is lowest in the North German Plain, where it fluctuates from 500 to 750 mm; in the Central German Uplands it ranges from nearly 750 to 1,500 mm and in the Alpine regions up to and exceeding 2,000 mm.

The weather varies from year to year, meaning a chilly spring and rainy summers one year can be followed by spectacularly warm and sunny in the next year. So the frequent changes of weather make forecasting difficult. One anomaly of the climate of Upper Bavaria is the occasional appearance of warm, dry air passing over the northern Alps to the Bavarian Plateau. These mild winds, known as fohens (*Föhn*), can create an optical phenomenon that makes the Alps visible from points where they normally would be out of sight, and they also are responsible for the abrupt melting of the snow.

Bibliographical reference:

http://www.about-germany.org/life/weather-in-germany.php

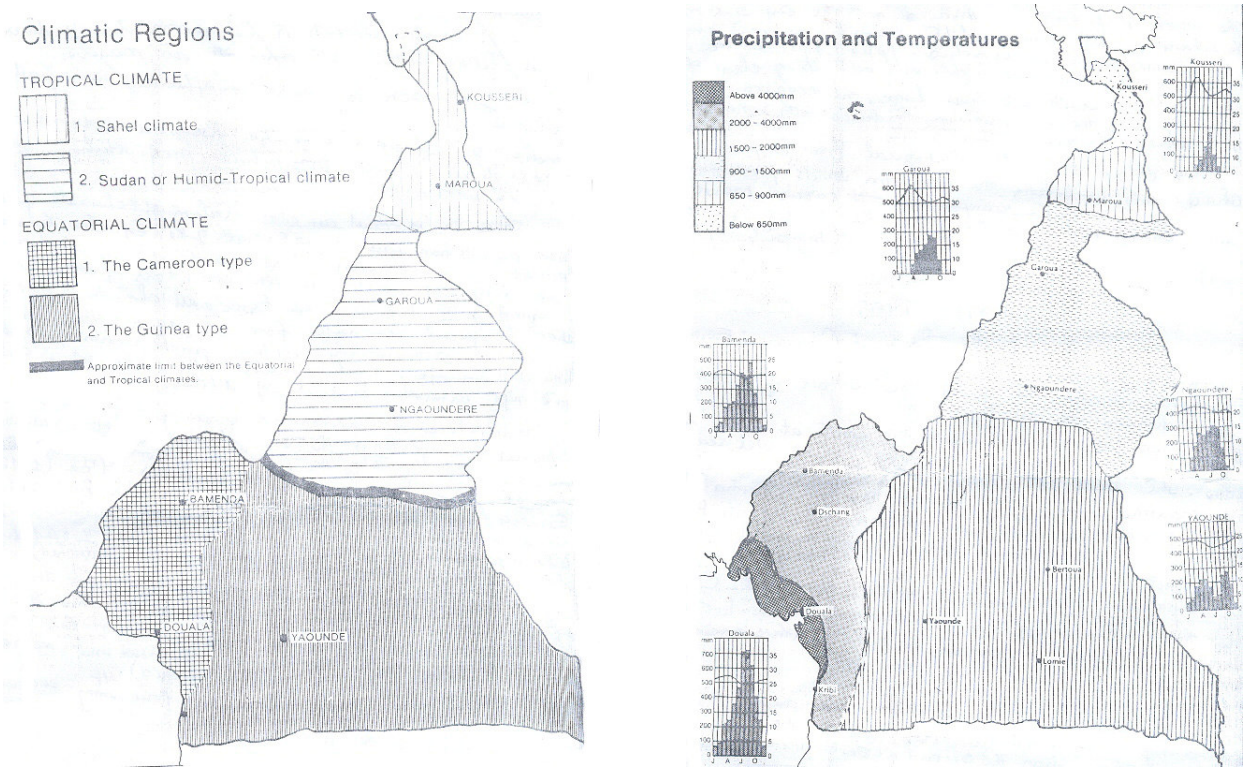
2.6. The climate of Cameroon

The climate of Cameroon can be discussed conveniently within the fabrics of its latitudinal extend, temperature, precipitation and air masses (wind patterns).

Cameroon extends from latitude 2° to 13° north of the equator. Thus, there is a zonal arrangement that gives Cameroon almost all the characteristics of inter-tropical climates, which are very hot, moist and dry conditions if local climatic fluxes or anomalies do not interplay. Between latitudes 2°-6° in the southern part of the country is found the equatorial type of climate and between latitudes 6°-13° north is found the tropical climate. However, local climatic fluxes such as continentality, altitude and proximity to the sea, for example, Buea has a cold and wet climate while Limbe, which is adjacent, has hot and wet climate because of altitude.

Temperatures in Cameroon are generally speaking high as in all inter-tropical areas. Annual average temperatures fluctuate between 20°-28°C. Nevertheless, temperatures

increase from the south towards the north and from the coast to the hinterlands. Also, altitude tends to influence temperatures. Yaounde (1120m) has 23.3℃ while Garoua in the Benue depression less than Yaounde has, 28℃. Besides**,** clear skies in the north cause many hours of sunshine (2.969 hours) while Douala in the south has 1841 hours of sunshine because of cloudy skies and humidity. (See figure 1 for graph and map of temperature).



Precipitation and humidity also reduce from the south to the north and from the coast into the interior. Douala has 4061mm, Yaounde has 1596mm, Bamenda has 2596mm, Garoua has 1000mm and Kousseri 630mm annually. However, local factors such as altitude, air masses and continentality are also important. (See figure 1 for a graph and map of rainfall).

Regarding seasons, there are four different seasons in the south of Cameroon – the long dry season at the start of the year, the long wet season from September to December, the short dry season in August and the short wet season between March and June. In the north, the raining and dry seasons are very important from the Adamawa to Lake Chad. The dry season stretches from November to April while the wet season stretches from May to October.

The seasons in Cameroon are principally controlled by air masses originating from the Azores in the north and Saint Helena in the south that converge to form the Inter-tropical Convergent Zone or Inter-tropical Front. The type of season in Cameroon depends essentially on the dominant trade winds blowing at the time. The Azores produces the

Harmattan from the desert in the north while St Helena produces the monsoon wind from the coastal south.

Harmattan produced from the north by the North East Trade winds brings hot and dry conditions as it passes across the Sahara as they start in October. During this period, the Azores is enforced and the Harmattan is stronger and moves further southerly to latitude 5°N. Thus, the north of Cameroon is invaded with dry season with dust blown from the Sahara causing poor visibility. Streams and rivers dry up and some reduce in volume, vegetation turns brown and scorched. People's lips, skin and feet crack. Days are very hot with cold nights because of clear skies.

In the south at this time, the Monsoon is weak but the adverse effects of the Harmattan are reduced with the humidity and rainfall relatively high. By July and August, the Inter-tropical Front is pushed up northwards to Lake Chad and the monsoon winds produced by St Helena carry moist air from the Atlantic and bring rains to the south of Cameroon. (See figure 2).

Climatic regions

There are generally two climatic types in Cameroon – equatorial and tropical climate.

A) Equatorial climate: It is found in the southern part of the country (between latitudes 2°-6°N). It can be divided into two types:

i) The Guinea type: it is found in the coast at Kribi and covers the entire southern plateau region of Cameroon. It has four seasons: two wet seasons and two dry seasons. On average the rains here range annually from 1500mm-2000mm. There is a double maxima (Yaounde has its first maxima in September and the other in between march and April) and minima (Yaounde has its first minima between December and January and the second between July and August). The average temperatures are constantly high (25°C).

ii)The Cameroon type: it is found in the southeastern part of Cameroon, to the river Sanaga and to the western highlands (Bafoussam and Bamenda). It is hot and humid with two distinct seasons: wet season for eight months and the dry season for four months. It can also be divided into two. Temperatures are fresh (21°C) on the average. Rainfall is however generally low and accompanied by tornadoes.

B) The Sahel climate: This climatic types stretches from the north of the Benue basin and covers the plains of Mayo Danay, Diarnare and Mandara. Precipitation is low and below 900mm with a longer drier season. Low atmospheric humidity increases average annual temperature ranges (37°C) and the level of dryness.

However, the Mandara being on high altitude has much humidity and lower temperature with a rainfall of about 967mm. In the Chad plain (latitude 11°N), arid conditions are quite intense with a rainfall of 630mm and the rainy season lasts three months with a higher rate of evaporation.

Ade Emmanuel

Geography teacher, Lycee Bilingue de Kribi

3. THE GAMESIDE OF GLOBE. LET'S START PLAYING!

In this section of the book we want to introduce a series of Environmental Education Games, which should help pupils to get easier access to the complex topic of environmental protection and especially climate change. Following games provide a new approach to the teaching/learning process where the learner needs to exploit his/her talents to the maximum for a better understanding unlike when the teacher gives every bit of information about the point in question.

During our work Cameroon we asked the students at the Teacher Training College in Buea (GTTC Buea), who were studying to become primary school teachers, about their opinion about the importance of using games in the learning process. The answers were:

- → Games lead to inferential thinking
- → Games promote individual participation of the learners and encourages healthy competitions and cooperation amongst the learners
- → Games uncover hidden talents
- → Games encourage active participation and dramatization of concepts even by average learners, thereby increasing the academic output.
- → Games lead to creativity
- → Games put the learner's concepts in the top priority over the theories and develop in him/her the confidence to present his/her opinion in public
- → Games improve learner/teacher relationship
- → Games impart retention and memory due to practical approach
- → Games are refreshing and educative
- → Teachers can easily see how good the pupils handle their knowledge

The games we introduce here can be modified and adapted to your personal classes. Feel free to copy them and spread them for non-commercial use.

All descriptions follow one pattern:

1) Purpose of the game
2) What should pupils know before playing this game
3) Material needed
4) Players
5) Time
6) Description
7) Remarks (the experiences we made with the game and some tips)

We hope to bring into your classroom a lot of knowledge, more joy, better understanding of climate change and love for environment.

3.1. Shoe-game "Weather and climate"

*Purpose***:** To find out students' opinion and understanding about subjects concern with the environment. Students should learn to defend their ideas. As the play is very flexible it can be used also in other subjects.

Should know: Basic data about the subject discussed. In this case about weather and climate

*Needed***:** Two papers with signs "Yes" and "No" or "Agree" and "Do not agree"; Pupils wearing shoes. Empty classroom or big hall.

Number of players: from 10 and on.

Time: 30 min (depending on how many questions are asked)

Description:

1. Pupils stand in a way that forms an ellipse. The signs "Yes" and "No" lie on the floor at the ends of longer axe of an ellipse.

2. The facilitator stands in the middle and asks players to take off their left shoe.

3. The facilitator will make a statement and after counting to three everybody throws their shoe to the side depending on whether or not they agree with the statement. In case they cannot make a decision, they throw their shoe in the centre or more to one side according to their opinion.

4. The facilitator takes one shoe from the different sides on the floor and asks shoe-owner to explain why they throw shoe there and what their opinion or understanding of the statement is. As a reward the person gets the shoe back. When 3-4 pupils asked understand clear, everybody can collect their shoes and the facilitator makes another statement.

The statements about weather and climate:

- I know the differences between weather and climate.
- I can name at least one item that is an outcome for climate change.
- Human actions are the most important causes of a climate change.
- Global climate change is a natural process and humans cannot do anything to stop it. (Individuals cannot do anything for preventing climate change. All has to be done by big companies and country governments).
- It would be nice to have 5 degrees warmer. It is anyway too cold.

- Only developed counties can reduce CO_2 emission because they have the money and technologies.

NB: Some statements can require concrete answers (like statement nr. 1) as well as state open-questions with no right answer (for example nr. 4 or 5).

We have often found that pupils have difficulties to distinguish between weather and climate. It is also important that everyone has his/her opinion and tries to discuss about the different concepts.

3.2. Sketch

Purpose: To think about how human actions influence the environment. And how our different behavior can improve or make situations worse.

Should know: No special knowledge required, though the picture chosen should be familiar to the students.

Needed: The pictures that show environmentally unfriendly activities.

Number of players: Group of 4–8 students work on one picture. There can be as many pictures as needed to divide the whole class into small groups.

Time: 30 minutes for preparation and two times 5 min for each group's presentation.

Description: The target is to become familiar with the situation on the picture and make two 5 minutes long sketches about the subject. One sketch should show the situation in the community and it influence on environment if the activity continues. The second sketch should show solutions how to change the situation and what would be the profits for the community and environment if people act differently.

1. Student will be divided into groups. Every group gets a picture to work with.
2. Groups work alone and discuss about the picture. They should answer the following questions:
   - What do you see on the picture? What is happening?
   - Does it happen in our community? How often?
   - Why is it happening?
   - What are the effects of it to humans and nature?
   - What can we do about it?
     - Individually?
     - As a community (town)?
     - Government?

3. The group prepares two sketches:

HAPPY END: If we do all the things we have to do, what will happen?

SAD END: If we fail to do all we should do or we will not start any sanctions, what will happen?

4. Everybody gathers in one room again and groups present their sketches, both "sad" and "happy" end. After two sketches from each group the facilitator should ask questions to the actors and from the others groups. Teacher should encourage pupils to discuss about the certain problem.

Questions for players:

- Did you feel different playing these two sketches? How did you feel? Was it better to play "sad" or "happy" end?

Questions for:

- What have you learnt watching those plays? What can you say about our environment /peoples' life-styles?

3.3. Story-telling

Purpose: The story telling should enable the pupils to remember the told story and to repeat given information with their own words. Therefore they remember better the information and learn to speak in front of the class

Should know: No special knowledge required.

Needed: The story (for example the story about Estonian, German or Cameroonian climate from this booklet)

Number of players: 4 -5 volunteers and the audience.

Time: 30 min.

Description:

All volunteers have to remember as many facts as possible. At the end volunteers' story will be compare with the original story.

1. All but one of the volunteers should leave the room. One volunteer and the audience hear the story and should listen carefully. No notes should be taken by volunteer or listeners. If the story is finished and the listener does not have any questions the next volunteer is asked to come in.
2. It is now the turn of the first listener to tell the story. After the story, teacher can allow the audience to add thing. The listener has to remember everything and tell the story to the next volunteer.

3. This procedure continues until the last person comes to listen. This person should write down the story's facts on the blackboard. After he gets the original story should read it loud again and correct the mistakes of the facts on the blackboard.

3.4. Energy-play

Purpose: To learn about different energy sources and what are the most sustainable and non-sustainable ways of producing energy.

Should know: Before starting to play, teacher should explain basic facts about the energy, especially concerning renewable and not-renewable sources.

Needed: Classroom big enough so that the whole group can walk around freely.

Number of participants: 15 and more.

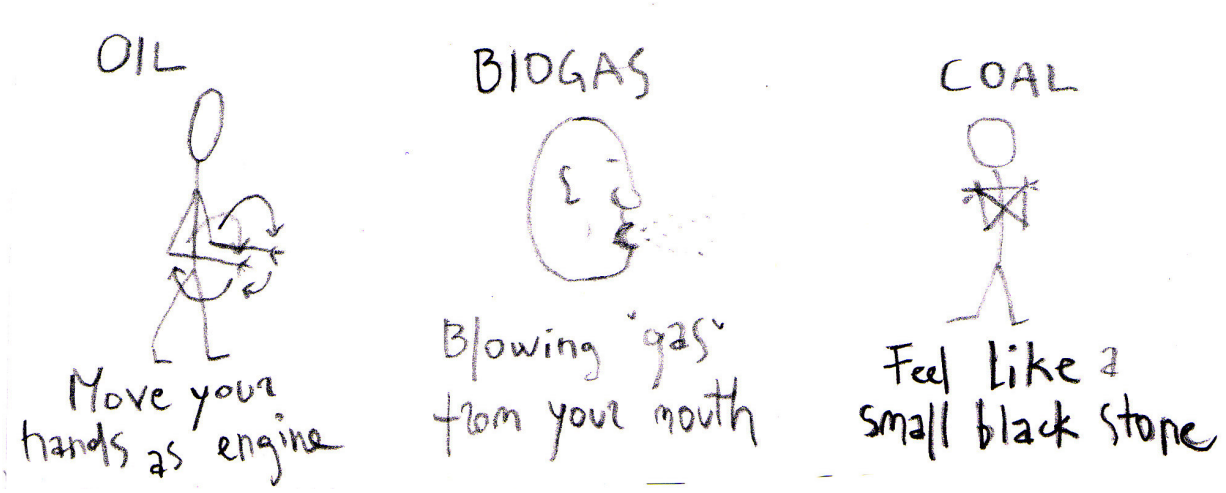
Time: 30 min

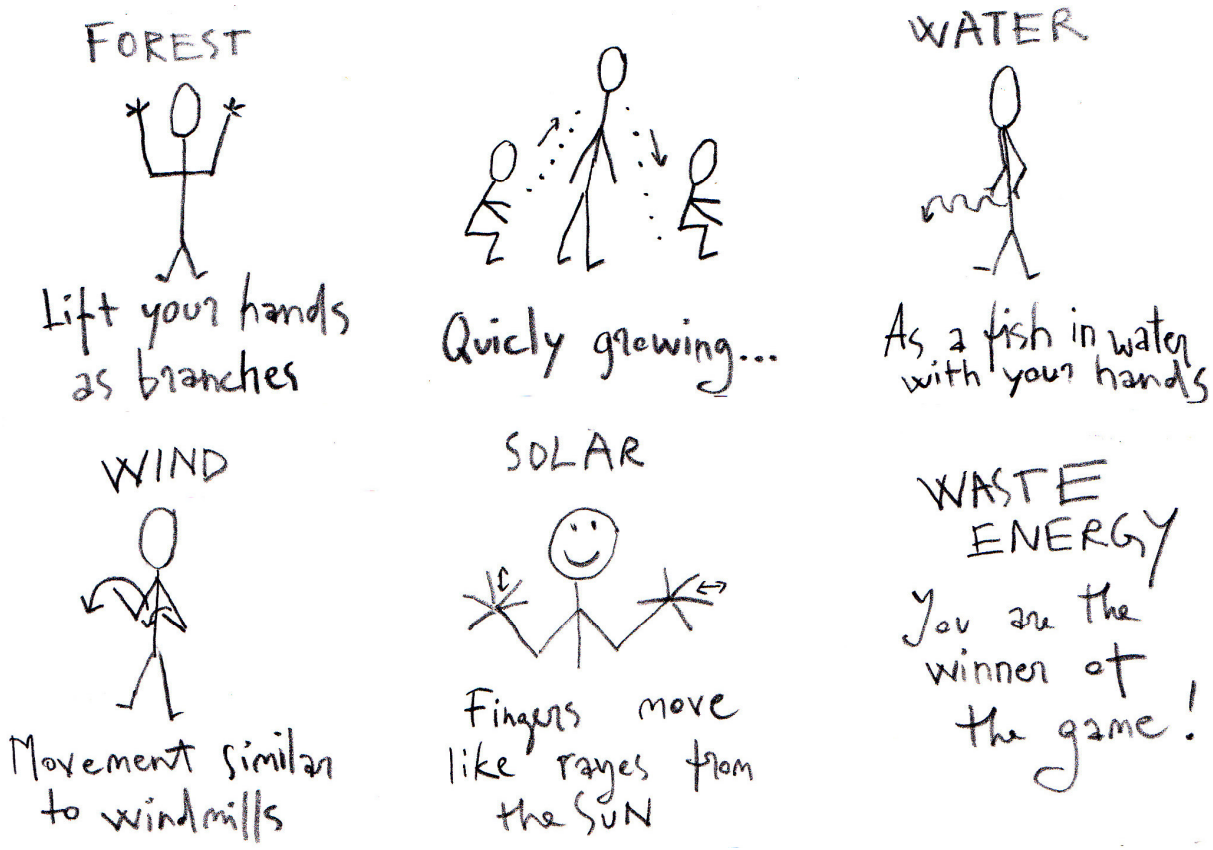
Description: The target is to make pupils understand that there is a great variety of energy sources. Within the play they should struggle to get from the less renewable energy-sources to the most renewable.

1. The different energy-sources used in the play are: oil, bio-gas, coal, forest/wood, fast growing energy bush, water energy, wind energy, solar energy, waste energy. (There could be added or erased some energy-sources depending on the ways of producing energy)

2. In the beginning of the play all students are on the level of the less renewable energy-source – oil. Each level means a certain movement that student should in order to let the others know at witch level they are. The movements are described on the pictures below.

4. To move from one level to another player has to find another player on his/her level (recognize them according to typical movement on each level).





5. They agree to play the game “stone-paper-scissors” (see the explanation below). Winners go to the next level, losers stay on the level he/she was and founds another partner to try again.

6. For being promoted from one level to another one can play only with player that is at the same level as he/she is.

7. The play will end when the first player has reached the last level.

8. At the end of the game players at each level should be counted and conclusion should be made that this is one of the profiles of the global energy production and there should always be different energy sources used not to exhaust one too much.

Stone – paper –scissors

1. Player meets another player from its level and they agree to play the game.
2. They stop their “energy movement” and count till three
3. After counting three both make a figure with a hand. Either:

Scissors + paper = scissors win cause can cut the paper

Stone + paper = paper wins cause covers the stone

Scissors + stone = stone wins cause make the scissors blunt

3.5. Crossword puzzle

Target: To test the knowledge about GLOPE protocols especially clouds. This particular game is however different because it aims at emphasizing the concepts of GLOBE protocols, and their understanding to the student. Therefore the game has been realized to be a challenging tool in investigating the level of understanding of students in GLOBE protocols.

Pupils should know: The pupils should be familiar with the GLOBE-protocols.

Needed: crossword puzzle and questions

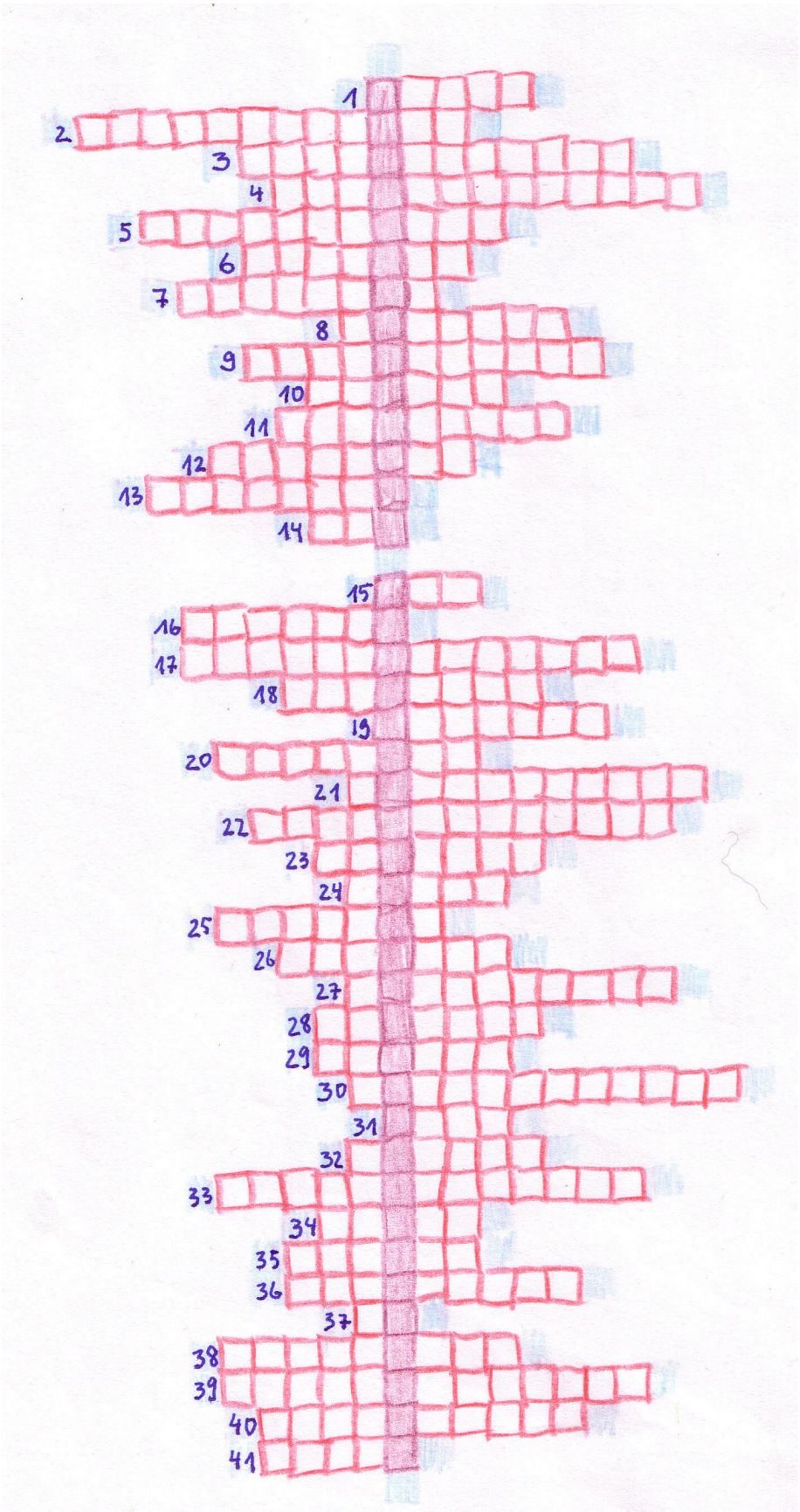
Number of players: -

Time: As the time depends on the knowledge of the pupils it is advisable to start it all together in class and to let it to be finished as homework. So that it is ensured that each pupil has enough time.

Purpose: The game, like any normal crossword puzzles aims at answering given questions in a given order, therefore realizing a uniform pattern. At the end of it all there is a key sentence found (read downward) or a key word if you align the marked letters the right way.

Preparations: copy of the puzzle

Mode: The pupils are given the crossword puzzle and the questions. They should write down the answers to each particular question according to their number. Each letter is written in one box. If an answer consists of more than one word the words should be merged together, leaving no space between them. When two words cross the letter in which they cross must be identical. Depending of which pattern you use at the end when all words are filled in, the pupils can read one sentence formed by a set of letters or they have to form a word from the highlighted letters.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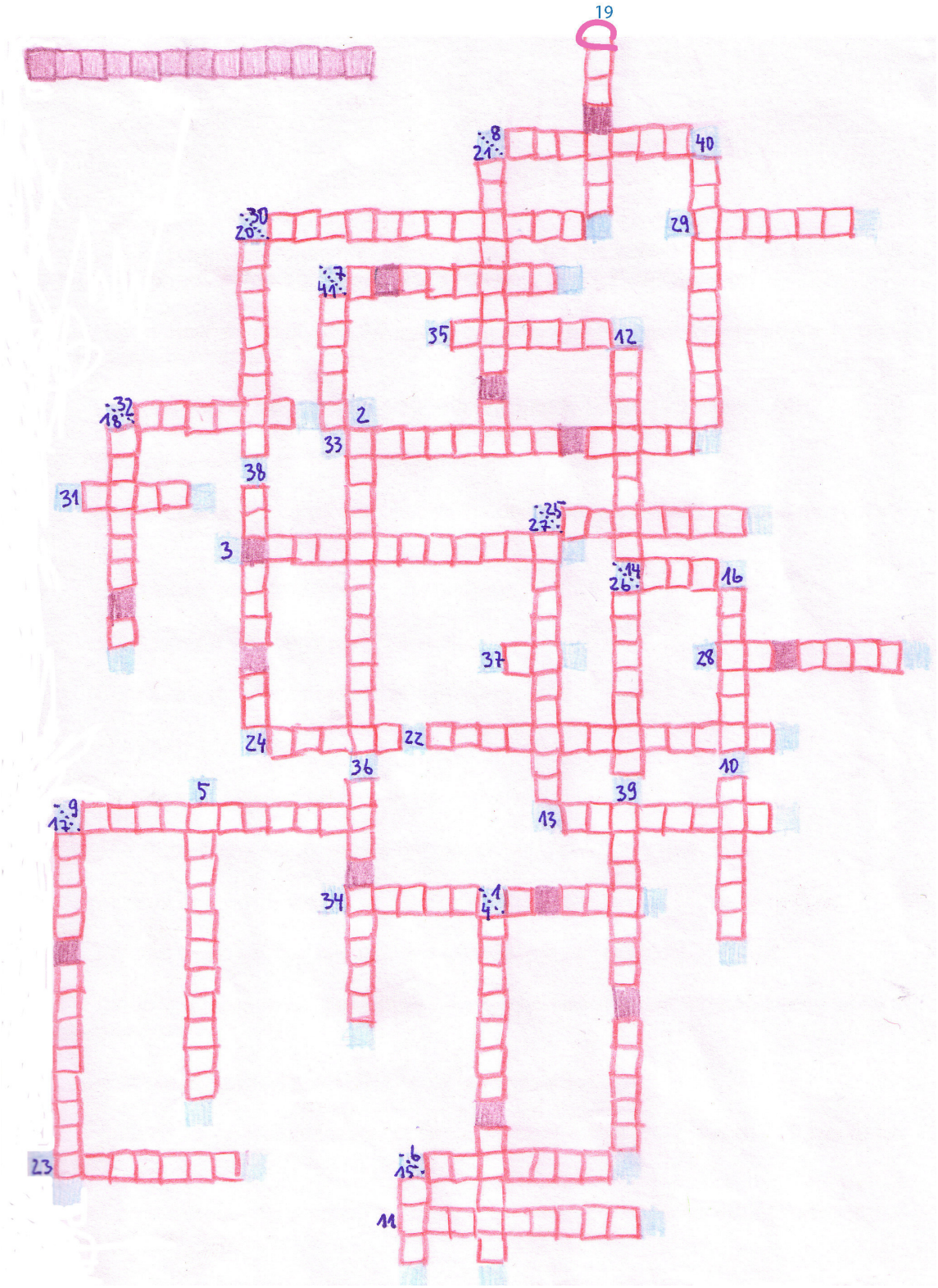
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Questions:

1. U.S.A- based environmental school program for the collection of data and studies oft he atmosphere, water, soil, land cover, phenology and GPS technology.
2. High clouds with puffy patchy appearance with small spaces between them, often forming wave-like patterns.
3. Low and middle clouds, dark-grey with precipitation falling from them.
4. Caused when the earth's atmosphere traps excesses heat.
5. Middle clouds, light grey and uniform in appearance, generally covering most of the skin.
6. Low clouds, puffy and look like cotton balls.
7. Dust, smoke and other particles in air.
8. Conditions of the atmosphere at a particular time.
9. The study of climate.
10. High clouds, thin and wispy with ice crystals.
11. The study of the reactions of plants to environmental changes.
12. Amount of water in the air.
13. Formed when sulphur and nitrogen gasses mix with moisture in the air.
14. Cloud-like masses of dense humid air, very close to the ground and often white in appearance.
15. Instrument used to measure elevation and position.
16. Caused by relative reflection of the sun's light on different portions of the earth's surface.
17. Large clouds with irregular masses, rolling or puffy appearance, sometimes with spaces between them.
18. Instrument used to tell wind direction.
19. The line separating the north and south hemispheres.
20. The means of communication of GLOBE data.
21. Change from liquid to gas.
22. Falling down of water from the atmosphere (rain, snow, etc)
23. Low clouds, light or dark grey, uniform in appearance covering most of the sky.
24. Areas where water bodies flow through.
25. Greenhouse gas also called marsh gas.
26. Conditions of the atmosphere, observed over about 30 years.

27. Water transparency instrument first used by Fr. Angelo Secchi.
28. The meaning of B in GLOBE.
29. The study of light.
30. High clouds, light grey or white, often thin, with the sun or moon seen through them, usually covering most of the sky.
31. Type of precipitation that consists of small ice crystals.
32. The coldest European season.
33. One of the main greenhouse gases also in taken by plants.
34. Three atoms of oxygen bonded together.
35. How is empty space called?
36. The study of water systems.
37. The level of acidity or alkalinity in a medium.
38. Dense fumes from the aircraft form …
39. As GLOBE Program is used in many countries it is an … program.
40. The board GLOBE students use for classifying clouds.
41. The most fertile layer of the soil.

Responses:

1. GLOBE
2. CIRROCUMULUS
3. NIMBOSTRATUS
4. GLOBALWARMING
5. ALTOSTRATUS
6. CUMULUS
7. AEROSOLS
8. ATHER
9. CLIMATOLOGY
10. CIRRUS
11. PHENOLOGY
12. HUMIDITY
13. ACID RAIN
14. FOG
15. GPS
16. ALBEDO
17. STRATOCUMULUS
18. WINDVANE
19. EQUATOR
20. INTERNET
21. EVAPORATION
22. PRECIPITATION
23. STRATUS
24. COAST
25. METHANE
26. CLIMATE

27. SECCHIDISC
28. BENEFIT
29. OPTICS
30. CIRROSTRATUS
31. SNOW
32. WINTER
33. CARBONDIOXIDE
34. ZONE
35. VACUUM
36. HYDROLOGY
37. pH
38. CONTRAILS
39. INTERNATIONAL
40. CLOUD CHART
41. HUMUS

3.6. Pollute and pay

Purpose: To identify friendly and unfriendly approaches to the environment and the global climate.

Pupils should know: If the pupils know already something about climate and the international agreements on climate issues. But in the presence of the teacher/facilitator they can be given some help.

Needed: the board, the questions/answers, cards with A, B, or C written on them to chose the answer, money bills, dice, as many seeds as players.

Number of players: Minimum 2 maximum 16, they should then form 4 groups of 4 persons.

Time: 45 min with 3 groups each of 4 players.

Target: To reach the finish point of the game as soon as possible with the highest amount of money possible in the player account starting with an initial amount of 50 Euro. Each player struggles to finish as early as possible and at the same time struggles to keep as much money as possible in his/her account.

Preparations: copy as many times the questions/answers as need.

MODE: The players throw a die in turns, and push their piece across the number of the squares (boxes) on the playing board as indicated by the number on the die face.

1) The player encounters a question which is responded to, he/she RANDOMLY chose a response card, hoping it bears the right response, A,B, or C, and the player earns credit, depending on the validity of the response,

   +5 Euro for the right response

   -5 Euro for the wrong one

   -10 Euro for the worst one

   Therefore, all the players decide (and agree) on which is the right response and wrong, and worse ones, before the player selects the card.

2) The player encounters a ladder of promotion where he/she can chose between paying an amount to the central bank and accepting the promotion, if need be, or turning down the offer and saving money, then continue normally.

3) The player encounters a stepless tunnel of demotion, which paves way for a lower step, probably due to the player being environmentally unfriendly at that step.

4) When one player reaches the winning point, for a two-player game, the game ends. For more than two players, the rest continue normally. The results are as follows in order of arrival at finish point:

   First = 100 points

   Second = 75 points

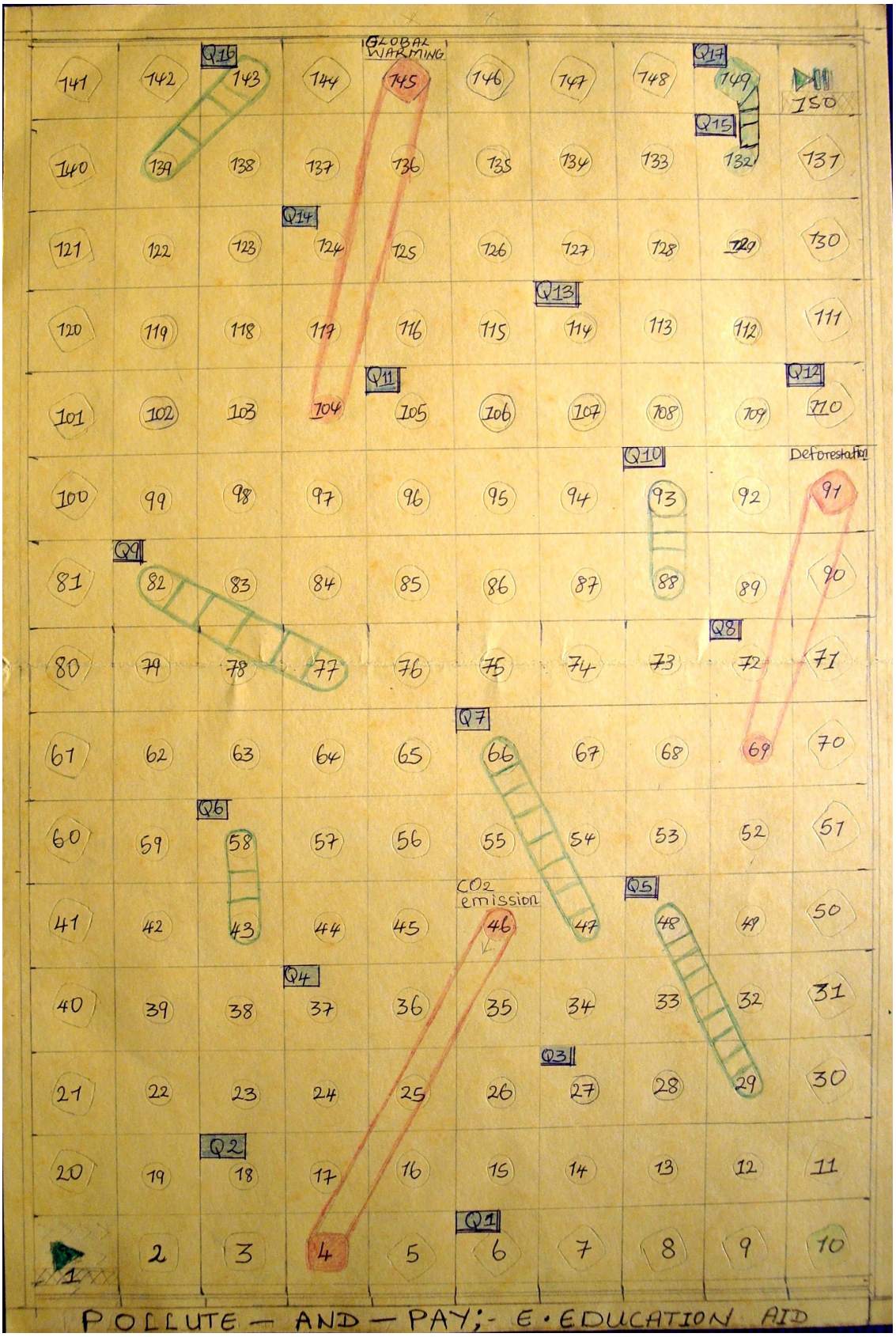
   Third = 50 points

   Fourth = 25 points

   Firth = 0 points

   N.B If more than five players take part, the group can modify the above points distribution such that only the last player has zero points.

   Final score per player = position at finish point + amount left in personal bank.


GLOBAL WARMING
Deforestation
CO2 emission
POLLUTE — AND — PAY;- E·EDUCATION AID

QUESTIONS/ANSWERS:

1. Which is the least polluting transport means?
    A. Car
    B. Bicycle
    C. Aircraft
2. Which is best in solid waste treatment?
    A. Open burning
    B. Landfills
    C. Incineration
3. Which would you prefer for forest conservation?
    A. Reforestation
    B. Selective Felling
    C. Random Felling
4. Which is the cleanest energy supply?
    A. Wind
    B. Biofuels
    C. Coal
5. How would you react to climate change?
    A. Use leaded fuel
    B. Reduce CO_2 emission
    C. Drive only in private cars
6. The friendliest gas
    A. Ozone
    B. Carbon dioxide
    C. Oxygen
7. Who should fight global warming?
    A. Heavily industrialized countries
    B. Nobody
    C. Everyone
8. If you were the UNEP Director, What would you do?
    A. Use more polluting fuels and produce more CFCs

B. Reduce CO_2 emission globally

C. Ask the World not to bother

9. Some climate agreements include;

A. Wood and fuel

B. Nevada and high temperatures

C. Montreal and Kyoto

10. It causes harsh climate

A. Temperatures

B. Greenhouse gases

C. Reforestation

11. Signs of climate change.

A. Floods and global warming

B. Acid rain and grasslands

C. Politics and world war three

12. UNEP is an arm of the United Nations in charge of;

A. The Earth

B. Eradication of poverty

C. The Environment

13. Rises in sea levels cause

A. Floods and death

B. Food and development

C. Food and death

14. The GLOBE program involves;

A. USA, Germany, Estonia and Cameroon

B. USA, Europe and Asia

C. USA and partner countries World - wide

15. The Montreal protocol focused on;

A. How AIDS affects the World's climate

B. Montreal and climate change

C. Substances that deplete the Ozone layer

16. Weather is to climate as;

A. Father is to wife

B. Daughter is to brother

C. Son is to family

17. Which is truest?

A. Climate change is the most interesting topic

B. Climate change is top priority in most countries

C. Climate change has solved many conflicts

3.7. Alias

Purpose: To explain and understand certain words and concepts related to the environment. The pupils have to express themselves freely and will remember better the concepts.

Should know: No particular knowledge is needed. The game is even easily adapted to the knowledge of your pupils or to a certain lesson by using your own word cards. Information cards can be used to deepen the pupils knowledge. You can play the game with or without them depending on time available, age, stage of knowledge. The information cards can be adapted to certain lessons and should motivate your pupils to discuss more about certain topics.

Needed: board, pieces, word cards and information cards.

How many: from 4 to 10. Bigger amounts of players can form bigger groups than couples.

Time: minimum 45 mi

Target: ALIAS is a word game that you play in teams. In ALIAS you have to say it in “other words”. The idea is to explain words using synonyms, opposites or clues so that your team mates guess as many words from the card as possible before the timer runs out. The team moves forward on the board the same amount as words guessed. The team to reach the ‘Finish’ first is the winner.

Description:

1. Shuffle the cards turning over the last card in the pack to indicate the need to reshuffle.
2. Each team chooses a coloured playing piece and places it on the Start.
3. Select a player to explain for the first round. This player then takes a suitable amount of cards from the pack (15-20). The cards each have eight words on them. The other teams then choose a number from 1 to 8, example No.4. The timer is turned over and the player starts to explain the word No. 4 (see “How to explain”). When the team guesses the correct answer he puts the card on the table and starts

explaining the word No. 4 from the next card. Numbers 1 – 8 do not correspond to any particular type of words. It is all based on luck if you get easy or hard words.

4. When the timer runs out, the other teams yell “stop”. If the player is still explaining the guessing becomes ‘open’ to all teams. The fastest correct answer wins allowing that team to move one space forward on the board.
5. The amount of cards on the table equals spaces to move forward. (see also “Mistakes and skipping cost”).
6. The turn goes to the next team. Used cards go to the bottom of the pack. The new team player refreshes their hand from the pack to have 15 – 20 cards. The category for the words is now shown on the game board by the coloured playing piece belonging to the team. Each team member takes a turn at explaining the words. (see also ‘Stealing’)
7. The team who is the first to reach ‘Finish’ is the winner.

How to explain

Only exact words are accepted!! For example, if the word is Running, Run is not good enough.

You cannot use any part of the word on the card, nor a derivative. For example you cannot explain the word “handbag” by saying “a small bag women usually carry”, or the word “balloon” by saying “a ball filled with air” since balloon and ball are derived from the same word. You could however say “a colourful object filled with air”. If the word has two parts for example “tape recorder” and someone guesses “tape player”. You can then use the first part by saying “the tape is right but use another word for player”. You can use opposites. The word “big” can be explained as “the opposite of small”. You cannot use foreign languages. As many hints and guesses are allowed until the word is found.

Mistakes and skipping cost

If the player explaining makes a mistake, the word will not be accepted and the team has to move one space backwards. For example, if a team guesses 6 words and makes two mistakes (6 – 2) they only move 4 spaces forward. The other teams must therefore pay close attention whilst teams are guessing. If the word seems too difficult, you can skip it, but remember this also costs one space backwards.

Stealing

The dark spaces on the board represent “stealing”. This means that when a team passes or stops on this space the play is ‘open’ to all teams. This is played without the timer with 6 cards, chosen number taken from the board. There is now one player explaining and everyone else guessing! The quickest team to guess wins one space forward. If a dark space is passed with a space it stole from another team this rule is then ignored. This is a good time to apply pressure to your opponents!

I-points

The I-spaces on the board represent “information-points”. This means that when one team stops on this space another team picks up an I-card and asks the team who stopped at

the I-point what they know about the mentioned key word. Think especially how this key word is influenced or influences climate change! The more correct ideas they bring out the more steps they can move forward: one space forward for each right fact. From the I-point you cannot go spaces backwards.

The I-points can also be used to examine certain already learned topics. Therefore the teacher reads out a question/key word and all pupils have to write down what they know about it. All papers are collected and after the game the teacher can evaluate them/give marks. In this case no one can move forward from I-point during the game.


S
W
GA
F

3.8. Role-play

Purpose: To let pupils experience different understandings of global climate change and allow them to see the complexity of the political and cultural dimension of it. Its focuses on CO_2 emission.

Should know: The better the understanding of CO_2-cycle and greenhouse effect is the better the game will turn out. The students should be aware of the different energy-sources and their different amount of pollution. The knowledge can be on different level. The outcome of the play depends on their specific knowledge and abilities in discussion; the outcome can be different while playing with different students

Needed: Clock, bell, balloons, copy of characters and requests, if needed copies of the guiding questions, nametags, guidelines written on the board, if possible some decorations for each character, paper and pens for writing request to the High Council.

Number of players: minimum 10, maximum 40. 2-4 persons should represent each character. The number of characters can be adjusted to the number of participants. The High Council should consist 3-4 students/teachers who are also the facilitators of the play.

Time: 2-3h.

Target: To find out the best solutions how the characters in collaboration with each other can reduce CO_2 emission in their everyday life. Characters that give the best contributions can attend United Nations conference on CO_2 emission and present their ideas there. It is left to the teachers when and if the conference will take place.

Preparations:

1) The room is arranged so that every group has a table facing the others with 2-4 persons per group.
2) The tables have signs with the name of character and on the table there are as many balloons as this concrete character emits CO_2 compared to the others.
3) The high council, which can be made up of students, stands in a forefront position.
4) All players including High Council should get nametags according to the character they play.
5) All stages of the game (with time duration) should be written on the board so that all the players respect order and time limits.

Mode:

1) The main progress in the game comes via discussion. All pupils should be ready to get into their characters and discuss, as this certain person would discuss.
2) In the different stages of the game, students have to find out, what the different characters can do to reduce their CO_2 emission, and how they can ally with others to reduce CO_2 emission.

3) For every stage of the play certain time has been given and pupils should respect time limits.

4) At the end of the play, there is a congress, where everyone has to present their outcome during a short speech and convince the council to their ideas in order to be send for the UN conference on global measure.

5) At the end every group destroys as many balloons as decided by the High Council and that indicates how much CO_2 emission they can reduce with their plan.

6) To sum up the play it is advisable to discuss with the students about what they can do about the CO_2 emission in their real lives. “UN congress” as a main price can be organized afterwards for example in front of whole school.

Stages of the play:

1) Every group gets acquainted with their characters. Everyone reads the description and discuss in the group how the character is responsible for CO_2 emission (10-15 min).

2) Present themselves to the other characters in a short speech (2 min each).

3) Groups’ discussion on possible cooperation with others: which character seemed to be the best for to cooperate with? which groups they want to send delegates to? (5min).

4) Mixed groups roundtable, when different characters discuss their proposals with each other. The aim is to find the character suitable for later cooperation? (5 min each).

5) Small groups discussion on whom you really want to work with and why. Presentation of requests with explanation to the Council (5 min).

6) Discuss and decision of High Council who works together. Every group should get one partner, accordingly or not to their request. (2 min).

7) Common work with partner’s character on how to reduce CO_2. Hand request and explanation to the Council. (20 min)

8) The Congress: presentation of groups’ plans to the others. The Congress is led by High Council. (5 min each)

9) Decision of the Council on how many balloons each character has to destroy and who has made the best contribution (5min).

10) Announcement of Council’s decision and pinching the balloons. The group with more balloons left wins the game.

11) Conclusion of the play, discussion about CO_2 emission and how global warming influences every day life of the players. How can we reduce CO_2 emission? (10min)

The characters:

A worker in an Estonian oil shale industry

"I am firstly responsible for my children to improve on their living standard."

“My name is Peeter Luuk. My two kids, my wife and me have to live well. I am working hard to make ends meet for then. Our house is heated with electricity. I travel every day by bus to work and on weekends by car to other towns for siteseeing, but never to foreign countries. We usually have lunch in a restaurant and dinner at home cooked by my wife with an electric oven. I do not know how much CO_2 we emit. My aim is to make life comfortable. At home we have kitchen equipment, washing machine, music set, TV and others.

→ Climate change is overestimated

→ We first have to catch up economically.

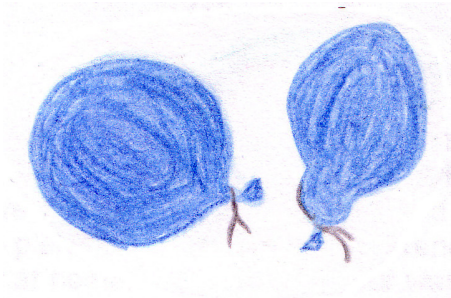
→ The ones affected by climate change have to deal with it. We have our own problems.

→ I cannot afford new technologies for lower CO_2 emission or better waste management.

→ Living expenses are already too high.

Worker in the Estonian NGO “Green Movement”

"If a man cannot fight to protect his life, then he is not fit to live.



“My name is Liis Pedajas. I live with my kid sister in a flat in the city center. We use about 8 m of wood every year in our oven for heating the house. I travel by bicycle or on foot everyday, and about once a week by bus and train. For cooking, we make use of electricity and we mostly have lunch in a restaurant and dinner at home. Our waste usually consist of organic, plastics and metals, which we pack in a bag weekly. Our electrical appliances include radio set, a washing machine and a computer which we use daily. I must confess our approach to the environment has not been the best. However, it is time to act, and we all must do so wisely.”

→ Pupils, students, and the general public must be sensitized to see into this problem. Nothing can be done at all if nations do not attach importance to aspects such as the Montreal and Kyoto protocols.

→ Energy demand and CO_2 emission are key factors, which have to be controlled.

→ The politicians should step up to the scientists and implement the proposals, based on facts.

→ There is no other way, apart from sensitization, collaboration, and implementation of techniques.

Estonian university professor

"Climate change may not be a threatening problem. A few degrees increase in temperature for example will make winters milder and summers more enjoyable"

"I am Mati Kallas, of the Tartu University. I live with my wife and two kids in a flat in Hiie Maja, Tartu. As Estonia is very cold, we can't help having a central house heating system. I travel quite a lot: everyday to work, every weekend for fieldwork (about 300km), once every two months by plane for international conferences. My family and I take lunch in restaurant and dinner at home, we channel all our waste (about 1.5m) every week to the bin. Equipment in use at home include kitchen electrical appliances, washing machine, TV set, computers and radios.

→ Given its small population, which even decreases annually, CO_2 and greenhouse gas emission from industries and transport are not very high, and so it is not a great threat, despite our CO_2 emission.

→ Although the oil shale and cement producing sectors emit CO_2 and other greenhouse gases, the demand for the product is not very high, and so it is not a great threat with the low population.

→ Estonia has a large forest, which can act as a carbon dioxide sink, if CO_2 emission increase and become a threat in the near future.

Consultant in a German car industry

“We need economic growth to keep our living standard.”

“I am Herman Schneider, sales consultant for a German car company. I have to protect the interest of the company. Economic growth is necessary to keep our living standard. I have the responsibility to keep our business running. Therefore we need to sell cars. I live with my wife and a son, we use many electric devices, including 2 TVs, 2 personal computers, microwave oven, washing machine, etc. and we have central heating. We drive about 200km per week in each of our 4 cars and if I have time we spent our holidays in Italy. We go there also by car.”

→ Developing countries have to act more because they suffer more from climate change than we do.

→ Our flexible industries in Germany provide quick solutions to environmental changes.

→ I think Germany has already done too much for environmental protection. We have ratified the Kyoto protocol and standards of energy, water and waste management are high, so other countries should catch up first.

→ Many other nations have economic profit from their lower standards and especially developing countries have much higher CO_2 emission than we do.

A German student

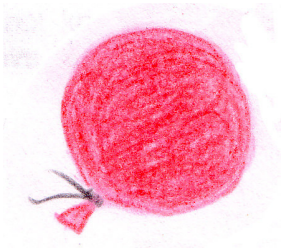
"I love to travel"

“My name is Martin Huber, and I am a law student in Dresden University. I like to spend a few weeks abroad each year, and so I travel a lot. I like to discover other countries and cultures; therefore I love to travel. Often I fly to European mayor cities over a long weekend. I know many people are concerned with the climate change issue, but I can't change anything. I have a TV, computer and washing machine in my house.”

- → I think humane contribution to climate change is over estimated.
- → Science is not real in their research for climate change.
- → I cannot sacrifice my joy for the fight against climate change.
- → I have heard that traveling in cars and planes harm the climate, but I cannot help.

A medium size family business person, Germany

"Act local, think global"



“I am Nora Gesten. I live with my husband and little daughter in the outskirts of Tuebingen. It's a very nice green area and luckily we live close to my parents. We recently set up our own business. A company, which provides information on how one can best use renewable energies. We have our own compost, and we buy only from shops where goods are packaged in recycling packages and food is grown without fertilizers. We have a car, which we hardly use, but walk on foot or by bikes. To reduce CO_2 emission and save money our house is a “passive house”. This means it doesn’t need heating at all as the isolation and energy conversion is so effective.”

- → At our level, we provide help for farmers companies and households on how to save energy and use renewable sources.
- → I think we should all help to protect the environment and to reduce CO_2 emission.
- → Many capacities are not used and we try to inform the people better -every contribution matters.
- → As politicians are reluctant to react we should start by reducing our energy demands and educating others.

Taxi driver from Cameroon

"Quite a lot is said about climate change but to me, I do not see how dreadful it is"

“I am called Atangana Bedemu. I have a wife and four children who all depend on the income from my taxi work, each turn occupies me more than eighteen hours daily. Taxi is the main mean of transport in Cameroon as there is no public transportation system. I can

afford just a few electrical appliances, which use electricity from Hydro Energy Plant and sure do not cause climate change. My wife cook with a gas cooker, and in hard times with a kerosene stove which science says is more explosive than gas, as it emits more CO_2."

→ If really CO_2 emission is a problem, those who believe in it should strive for it prevention.

→ Toxicologists and climate scientists say we shouldn't use cheap and leaded fuel. How do we survive if we use expensive fuel? How much can Cameroonians pay for a taxi drop?

→ Industrialization they say causes harsh climate. Why then do they bother us about climatic change? Shouldn't industrialized countries pay for the harm they have done to this world?

<u>The Cameroonian parliamentarian</u>

"The climate change problem is real. Let the leading polluters show the way to the solution."

"I am Ndoumbe Ebongue; I live with my three children in a villa in Bastos, where we usually use air conditioning to cool the house. We also use gas cooker in the kitchen, as well as refrigerators, electric irons, laundry machines and other electrical appliances. I travel a lot in town and from town to town in my Mercedes car and in aircraft when I travel out of the country (usually about thrice a year). I know that my needs and appliances produce CO_2 and CFCs but I think I am not a high polluter for climate change."

→ Climate change is a great and one of the most talk-about world problem

→ The heavily industrialized nations are more than 90% responsible for CO_2 and green house gas emissions.

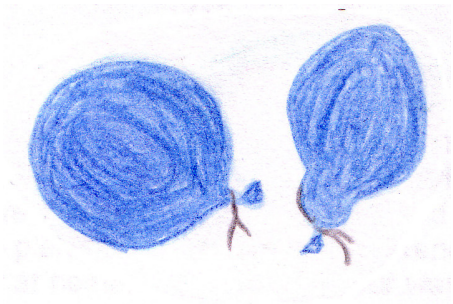
→ Cameroon can only contribute through environmental education, and improving on citizen's behavior and habits with the environment, given the small economic strength.

→ The *pollute and pay principle* should be ensured at international levels, and even at the United Nations.

→ North America, West and Central Europe, and other heavily industrialized nations should contribute more in improving the situation.

The Cameroonian farmer

"Climate change is a real and dreadful problem, but I cannot help the situation."



“My name is Abdourazack Ishmaelah. I live in Sabga towards the Ndop plains with my wife and five children in a three-room house at the village side I earn very little from my few cattle, and a farm. I emit insignificant very low amounts of CO_2, CFCs and greenhouse gases, especially as I do not use machines in my farm, but occasionally burn bushes.”

→ Climate change is a threat to us all. It causes very low yields and brings so many uncontrollable pests.

→ Good measures to increase yields are very expensive, let alone to combat climate change.

→ The government cannot fully support agriculture, and so we cannot help bush burning.

→ Scientists say tree felling causes climate change. But I cannot help it. It is essential in my agricultural practices.

→ The government and international bodies must do something somehow if we must survive.

→ We need more environmental friendly techniques, to use in agriculture on which our lives depend.

End of the role play

The end of the role play depends highly on how the students can make use of their knowledge. They should present their opinions on how to reduce CO_2 freely, but the facilitator/teacher should afterwards encourage a discussion on effectiveness and feasibility. We collected some proposals to show the variety:

- The masses worldwide should be educated on the consequences of CO_2-emission, so they are aware of their actions and lifestyles.
- Individuals should reduce their frequencies of car use.
- Governments should impose higher taxes on old high CO_2 emitting technologies.
- Reforestation should be strictly enforced.
- Bush burning for rampant tree-clearing should be prohibited.
- Recycling facilities usage of renewable energies and cleaner technologies should be facilitated.

We want to emphasize that main idea of the play is to make pupils understand that everyone can do something about climate change. Often it happened that means to reduce CO_2 are mixed with general environmentally friendly behavior. Pupils should be sensitized on the differences. Means which reduce CO_2 but still cause pollution should be eliminated. Some common misunderstandings we have found were:

- Mixing of CFC and CO_2.
- Mixing ozone layer depletion with greenhouse effect.
- Reducing CO_2 by using electricity instead of wood, coal which mostly only produces CO_2 in another place if the country does not have “green energy” sources.
- Reducing CO_2 emission from one person by passing it to another or by contaminating in an other way e.g. not to use a washing machine (electric devise which needs energy = CO_2-emission) but wash your cloth by hand (= uses more water) in the stream (= pollutes the stream) or go to dry cleaner (= same CO_2 –emission)

Another important issue is to point out that there are many smart technologies to make good use of energy. Without doubt energy demand is indispensable, people would always need access to light, heating, cooling and transport, but it should be used wisely.

3.9. Feedback “The hand”

Purpose: To evaluate the session.

Should know: should have participated in the session

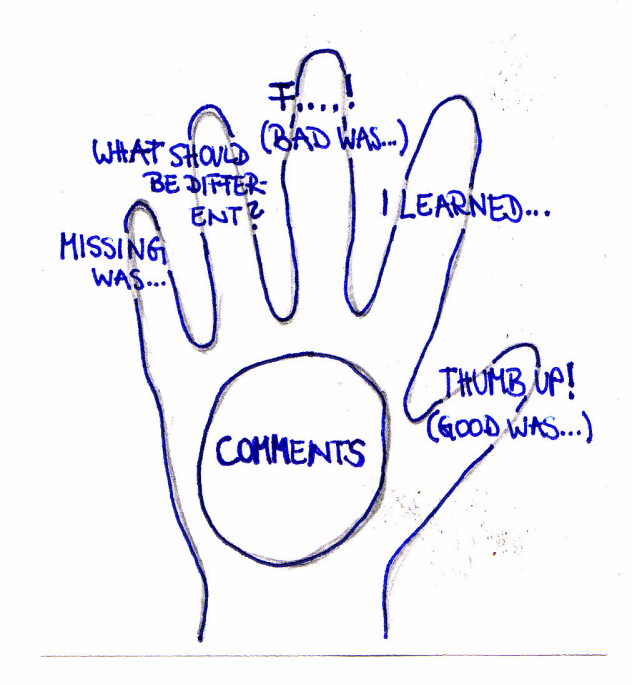
Needed: paper and pen for everyone

Number of participants: whole group.

Time: 10min

Description:

1. Everybody gets a paper and finds a pen.
2. The facilitators ask participants to put one hand on the paper and draw the shape of it.
3. The facilitator asks participants to think about the event/session that has just taken place and write the following questions on every finger (see the drawing below) and in the centre of the hand some comments they think should be stressed for the facilitators. It should be emphasized, that no name should be written on the paper and everyone should answer freely and do not hesitate criticism.
4. After this activity facilitators can read the opinion of the participants and conclude how much they have gained from the session and what remains unclear.



We used this method mostly in Cameroon as we visited many different schools. Therefore we give here the feedback from our stay in Cameroon as an example how the outcome looked like. It helped us a lot to improve plays and games in this book.

THE THUMB, “GOOD”: most pupils mentioned that it was good to learn some new games and some new facts we have introduced. Also that it was good to receive visitors.

FORE FINGER, “LEARNED”: They mentioned the points we had been talking about during our session. It was often mentioned that they have learned how to express themselves in front of the group and how to work in a group as well as they have learned new games they can now introduce to they friends.

MIDFINGER, “WAS BAD”: Often students didn’t want to write anything bad. But some wrote more philosophical facts, for example “is bad that the climate in Estonia is so cold”. Sometimes the bad thing was that other pupils were noisy or that they were hungry or that all pupils could not participate in the games due to too many students in environmental clubs. Bad was also, that our stay was so short.

INDEX FINGER, “DIDIN’T UNDERTAND”: from the hands we often read that some points we tried to explain remained unclear. Our spoken English was difficult to understand for the pupils due to uncommon accent. They also wrote some questions that never came up during the meeting, but would have been interesting to discuss with them.

SMALL FINGER, “MISSING”: Here students were supposed to write what they were expecting from our session but we have never discussed. Often it was the lack of the presentation about our home countries as because of a short time we often made it very briefly. Enough time was often missing and the students wanted to hear about some subjects we were not even supposed to talk about – marine life, AIDS, etc.

THE PALM, “COMMENTS”: Those comments were very positive and full of good wishes for the visitors. Thank you!

Remarks: As we were discussing a lot during own session with the students and they asked quite many questions. We tried to answer it was still surprising to read the hands and find out many misunderstandings and questions that still stayed to them. Hopefully they keep on looking for the answers.

4. CONCLUSION

Quicker than expected, we find ourselves at the end of this project after six months of traveling in Estonia, Germany and Cameroon.

All over these three countries, the places are very memorable us, and we are grateful to have been given the opportunity to see all these places and to directly experience the impacts of the different climatic regions. This ecological diversity and varying climate was itself challenging, as well as the intercultural composition of the team. The project topic “climate change education for schools and elaboration of didactic material based on GLOBE protocols” was even more challenged, and despite some difficulties, the participants met their objectives. They displayed a strong sense of responsibility in science and environmental education, geography, and culture of the three countries.

Climate change is a real threat to man’s survival. This, the participants conclude after a tour in the three countries, observing the different implications of climate change and meeting so many helpful resource persons, even in “very cold Estonia”, or in “very hot Cameroon”. Floods, diseases, desertification, global warming, acid rains, etc are the numerous hazards that lie in store for our world if we do not become more responsible in our interactions and combat climate change.

No one is left out. Everyone can contribute significantly, even you.

LESLIE NJUME, EMEH

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Born on August 8, 1982 in Nyasoso, South-West province of Cameroon, Leslie studied in G.H.S Nyasoso and C.C.A.S.T Bambili, where he obtained his G.C.E.O and A levels respectively. He joined the GLOBE program when in his first year in the university, represented the environmental science students university of Buea, in a GLOBE training workshop in Bandjoun, December 2004.

Before taking part in this project, he has participated in GLOBE Cameroon events, seminars national and international training of GLOBE trainers workshops as a GLOBE student, facilitator, and resource person. He is a member of the GLOBE alumni in Cameroon and the African sub-region. Prior to obtaining his degree in environmental science, university of Buea In the field of Environmental Science, Leslie is keen in studying more on topics such as solid waste management, sewage and water quality, disease control, and environmental impact assessment.

MARI NUGA

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Born on October 20, 1982 in Tallinn, the capital of Estonia, Mari studied 9 years in Kivimäe Primary School and 3 years in Tallinn Science School. First contact with the GLOBE was during secondary school but the participation was not very active. From the year 2001 Mari is studying geography in the University of Tartu, after this project she is starting her PhD program.

In her university studies Mari is going to specialize on pedestrian movements and city planning. As she has been taking actively part in the NGOs Tartu Students Nature Protection Circle and Estonian Green Movement the idea of nature protection is very important for her. The hands-on approach to the nature studies bring people closer to their environment therefore the need to protect it is easier to understand.

SIMONE MAREN LEPPER

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Born on September 21, 1981 in Konstanz, a small town at the Bodensee in Germany, Simone studied 4 years in Sonnenhalde Primary School and 9 years in Heinrich Suso Gymnasium. From the year 2000 Simone was studying in the University of Freiburg, where she graduated in March 2006 with a Masters degree in chemistry. She did an internship at the *Consejo Superior de Investigaciones Científicas* Madrid for 6 month in 2003/4.

In her university studies Simone specialized on Biochemistry. Due to her interest in environmental protection she got to know GLOBE and found the idea of sensitizing already youngsters how important scientific research and environmental protection is very challenging. Beside the scientific approach the intercultural aspect of GLOBE is very important to her.

NJOMOU LEONIE

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Born in Yaounde, the capital of Cameroon, a country at the heart of Africa, she is 32 years old. Leonie works in the GLOBE Program Regional Conference Centre as "Administrative Assistant" to the GLOBE Program Regional Coordinator for Africa and country coordinator for Cameroon, it is within this, that she got involved in the project GLOBE and ASA.

She did nursery, primary and secondary education in Yaounde, then went to the University of Yaounde I, she studied Psychology, particularly the School and Child clinical psychology and Psychopathology link with Science of Education. She also did a trainning of "Secretariat Bureautique"; of "Computer Graphics".

She is interested in the elaboration of teaching techniques for students. She discovered in the research that each child have a particular way to learn and understand the best.